

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

**Assistant Commissioner for Patents
United States Patent and Trademark
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Washington, D.C.20231
ETATS-UNIS D'AMERIQUE**

in its capacity as elected Office

Date of mailing (day/month/year) 28 September 2000 (28.09.00)	in its capacity as elected Office
International application No. PCT/FI99/00652	Applicant's or agent's file reference 2980355PC/su
International filing date (day/month/year) 05 August 1999 (05.08.99)	Priority date (day/month/year) 06 August 1998 (06.08.98)
Applicant AALTO, Mika et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

28 February 2000 (28.02.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer</p> <p>C. Cupello</p> <p>Telephone No.: (41-22) 338.83.38</p>
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PCT REQUEST

2980355PC/su

Original (for SUBMISSION) - printed on 05.08.1999 01:01:24 PM

0 0-1	For receiving Office use only International Application No.	PCT/FI 99 / 0 0 6 5 2
0-2	International Filing Date	0 5 AUG 1999 (0 5. 08. 99)
0-3	Name of receiving Office and "PCT International Application"	The Finnish Patent Office PCT International Application
0-4 0-4-1	Form - PCT/RO/101 PCT Request Prepared using	PCT-EASY Version 2.84 (updated 01.07.1999)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	National Board of Patents and Registration (Finland) (RO/FI)
0-7	Applicant's or agent's file reference	2980355PC/su
I	Title of invention	INTERNET/INTRANET ACCESS MECHANISM
II II-1 II-2 II-4 II-5	Applicant This person is: Applicant for Name Address:	applicant only all designated States except US NOKIA TELECOMMUNICATIONS OY Keilalahdentie 4 FIN-02150 Espoo Finland
II-6 II-7	State of nationality State of residence	FI FI
III-1 III-1-1 III-1-2 III-1-4 III-1-5	Applicant and/or inventor This person is: Applicant for Name (LAST, First) Address:	applicant and inventor US only AALTO, Mika Kiskottajankuja 3 F 48 FIN-02660 Espoo Finland
III-1-6 III-1-7	State of nationality State of residence	FI FI
III-2 III-2-1 III-2-2 III-2-4 III-2-5	Applicant and/or inventor This person is: Applicant for Name (LAST, First) Address:	applicant and inventor US only LAKSO, Marja LAKSO Kristianinkatu 11-13 B 40 FIN-00170 Helsinki Finland
III-2-6 III-2-7	State of nationality State of residence	FI FI

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III-3	Applicant and/or inventor	applicant and inventor US only NYMAN, Kai Kirkkalantie 17 FIN-02660 Espoo Finland FI FI
III-3-1	This person is:	
III-3-2	Applicant for	
III-3-4	Name (LAST, First)	
III-3-5	Address:	
III-3-6	State of nationality	
III-3-7	State of residence	
IV-1	Agent or common representative; or address for correspondence The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent KOLSTER OY AB Iso Roobertinkatu 23 P.O. Box 148 FIN-00121 Helsinki Finland + 358 9 618 821 + 358 9 602 244 Kolster@Kolster.Fi
IV-1-1	Name	
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IV-1-3	Telephone No.	
IV-1-4	Facsimile No.	
IV-1-5	e-mail	
V	Designation of States	AP: GH GM KE LS MW SD SL SZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	

PCT REQUEST


2980355PC/su

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V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AE AL AM AT (patent and utility model) AU AZ BA BB BG BR BY CA CH&LI CN CR CU CZ (patent and utility model) DE (patent and utility model) DK (patent and utility model) EE (patent and utility model) ES FI (patent and utility model) GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK (patent and utility model) SL TJ TM TR TT UA UG US UZ VN YU ZA ZW	
V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.		
V-6	Exclusion(s) from precautionary designations	NONE	
VI-1	Priority claim of earlier national application		
VI-1-1	Filing date	06 August 1998 (06.08.1998)	
VI-1-2	Number	981708	
VI-1-3	Country	FI	
VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1	
VII-1	International Searching Authority Chosen	Swedish Patent Office (ISA/SE)	
VIII	Check list	number of sheets	electronic file(s) attached
VIII-1	Request	4	-
VIII-2	Description	5	-
VIII-3	Claims	3	-
VIII-4	Abstract	1	2980355p.txt
VIII-5	Drawings	1	-
VIII-7	TOTAL	14	
	Accompanying items	paper document(s) attached	electronic file(s) attached
VIII-8	Fee calculation sheet	✓	-
VIII-10	Copy of general power of attorney	✓	-
VIII-16	PCT-EASY diskette	-	diskette
VIII-17	Other (specified):	Copy of Official Action	-

PCT REQUEST

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VIII-18	Figure of the drawings which should accompany the abstract	1
VIII-19	Language of filing of the international application	English
IX-1	Signature of applicant or agent	 Antti Peltonen
IX-1-1	Name	KOLSTER OY AB

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10-1	Date of actual receipt of the purported international application	0 5 AUG 1999 (0 5 -08- 1999)
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/SE
10-6	Transmittal of search copy delayed until search fee is paid	

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11-1	Date of receipt of the record copy by the International Bureau	
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 2980355PC/su	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/FI99/00652	International filing date (day/month/year) 05.08.1999	Priority date (day/month/year) 06.08.1998
International Patent Classification (IPC) or national classification and IPC ₇ H04Q 11/04; H04L 12/56		
Applicant Nokia Networks OY et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of _____ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 28.02.2000	Date of completion of this report 09.11.2000
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88 Form PCT/IPEA/409 (cover sheet) (January 1998)	Authorized officer Jan Silfverling/LR Telephone No. 08-782 25 00

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI99/00652

I. Basis of the report

1. With regard to the elements of the international application:*

- ☒ the international application as originally filed
- ☐ the description:
 pages _____, as originally filed
 pages _____, filed with the demand
 pages _____, filed with the letter of _____
- ☐ the claims:
 pages _____, as originally filed
 pages _____, as amended (together with any statement) under article 19
 pages _____, filed with the demand
 pages _____, filed with the letter of _____
- ☐ the drawings:
 pages _____, as originally filed
 pages _____, filed with the demand
 pages _____, filed with the letter of _____
- ☐ the sequence listing part of the description:
 pages _____, as originally filed
 pages _____, filed with the demand
 pages _____, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item. These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI99/00652

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims	<u>1-13</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-13</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-13</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)**Citations**

The examination process has revealed the following documents, which represent the general state of the art:

D1: EP 070 02 31 A2

D2: "Anx-High-Speed Internet Access", Ericsson Review, Volume 1b, 1998; Patrik Nilsson et al.

D3: "High Speed Internet Access over ADSL: Making it happen", Telecommunications Review, volume 4, 1997; W. Verbiest

D4: EP 087 30 38 A2

D5: WO 98 36 608 A2

D6: WO 96 38 962 A1

The claimed invention

The claimed invention relates to an Internet accessing method through an asynchronous transfer mode (ATM) network, which involves employing access server function, which converts customer premises equipment to selected service provider.

The customer premises equipment (CPE) selects an appropriate service provider (SP), using the integrated signalling protocol. The access server function (ASF) performs routing from CPE to selected SP. The ASF connects the CPE to the selected SP, using the integrated signalling protocol.

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI99/00652

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V

Initially, each CPE is connected to an ATM network, via corresponding network termination point (NT). The access server function (ASF) having permanent virtual connection to each NT and service provider (SP) is established. A tunnelling protocol is established on permanent virtual connection between the NT and ASF, to support the integrated signalling protocol. The tunnelling protocol is permanently established, the integrated signalling is initiated and the user of CPE is authenticated, based on the detection result about appropriate activity in the CPE. A pool of permanent virtual connections from the ASF to each SP is also provided, and a single connection is allocated to each NT from that pool. One switched virtual connection (SVC) is established from the ASF to each SP, on the basis of signalling received by ASF from the CPE through the tunnelling protocol.

The advantage of the invention is that the method does not require changes to the construction or operation of the SP equipment. Further, it offers one permanent virtual connection between each NT and ASF and enables automatic configuration of LAN interface by dynamic host configuration protocol (DHCP) based process, as defined by the Internet software consortium.

Statement

The document D1 discloses a method and system for interprocess communication and inter-network data transfer.

Document D2 presents an ATM based broadband access platform, providing high-speed Internet access.

Document D3 concerns a high-speed Internet access using ADSL.

In document D4 is a method and system providing high-speed Internet access over an ATM network presented.

Document D5 reveals a method and apparatus for multiplexing of multiple users on the same virtual circuit.

From document D6 is a communication network integration system known.

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

National application No.

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Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Suppl.1

From D1 (see column 3, line 12- line 52) a method and system for interprocess communication and inter-network data transfer is known. D1 presents a method and system for transmitting data, using ATM formatted frames and the network transmits data in Internet protocol (IP) packets.

The claimed invention differs from what is previously known through document D1. The claimed invention according to claims 1-13 is based on the use of a tunnelling protocol in order to establish a permanent virtual connection between each network termination point and access server function.

This difference is not considered obvious to a person skilled in the art. Accordingly, the claimed invention as described in claims 1-13 seems to involve an inventive step.

From D2 is known Internet access mechanisms for connecting each of several consumer premises equipment via an ATM network to one of several service providers. The network comprises an access server function having a connection to each network termination point and each Internet service provider such that each network termination point has a permanent connection to an access node.

However, the claimed invention differs from what is known from D2, mainly in that a specific end user can be connected to the desired service provider with a minimal number of permanent virtual circuits and having the possibility of end-user authentication taking place only at the end of the permanent virtual circuits.

Therefore, the claimed invention seems to provide features, not obvious to a person skilled in the art. Thus, the claimed invention according to claims 1-13 is considered involving an inventive step.

Document D3 teaches a method for a high-speed Internet access using ADSL. However, the document D3 is considered as not conflicting with the claimed invention. Thus, the method as described in D3 is considered as describing the general state of the art.

Documents D4-D6 are considered as describing the general state of the art. They do not seem to conflict with the claimed invention.

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI99/00652

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Suppl.2

Conclusion

The claimed invention according to patent claims 1-13 is considered to involve an inventive step.

A.D

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WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : H04Q 11/00, H04L 29/06	A2	(11) International Publication Number: WO 00/08890 (43) International Publication Date: 17 February 2000 (17.02.00)
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(21) International Application Number: PCT/FI99/00652

(22) International Filing Date: 5 August 1999 (05.08.99)

(30) Priority Data:
981708 6 August 1998 (06.08.98) FI

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(72) Inventors; and
(75) Inventors/Applicants (for US only): AALTO, Mika [FI/FI]; Kiskottajankuja 3 F 48, FIN-02660 Espoo (FI). LAKSO, Marja [FI/FI]; Kristianinkatu 11-13 B 40, FIN-00170 Helsinki (FI). NYMAN, Kai [FI/FI]; Kirkkalantie 17, FIN-02660 Espoo (FI).

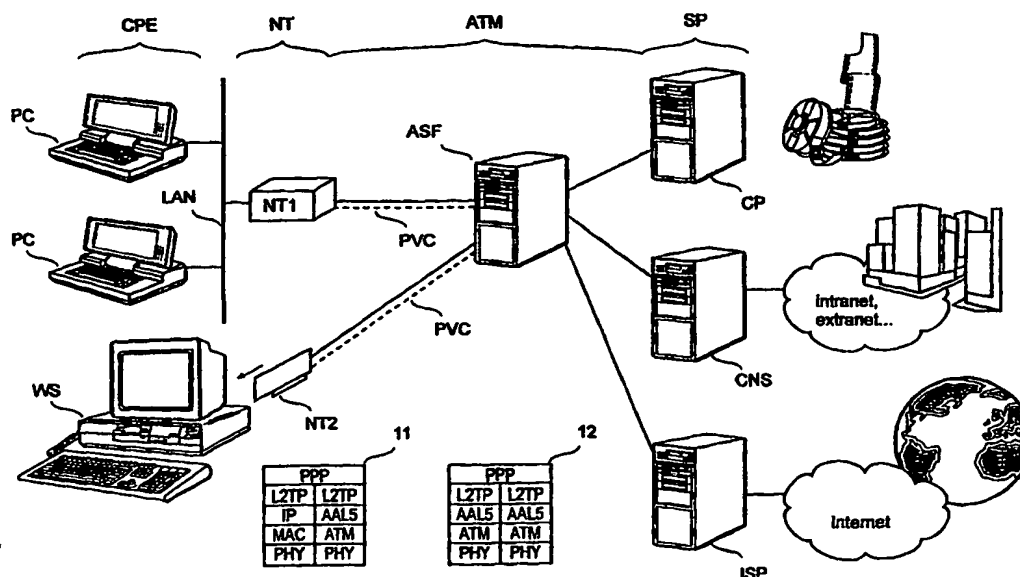
(74) Agent: KOLSTER OY AB; Iso Roobertinkatu 23, P.O. Box 148, FIN-00121 Helsinki (FI).

(81) Designated States: AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

Without international search report and to be republished upon receipt of that report.

(54) Title: INTERNET/INTRANET ACCESS MECHANISM



(57) Abstract

A method for connecting one of several customer premises equipment (CPE) via an ATM network to one of several service providers (SP). Each CPE is connected to the ATM network via a corresponding network termination point (NT). There is an access server function (ASF), having a permanent virtual connection (PVC) to each NT and a connection to each SP. A tunnelling protocol is established on the permanent virtual connection between each NT and the ASF. The tunnelling protocol is able to support an integrated signalling protocol. The CPE or its user selects an appropriate SP by using the integrated signalling protocol. Routing from the CPE to the selected SP is performed by the ASF. The ASF connects the CPE to the selected SP using the integrated signalling protocol.

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Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

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EE	Estonia						

Internet/intranet access mechanism

Background of the invention

The invention relates to a mechanism for accessing the Internet via an ATM (Asynchronous Transfer Mode) network. Within the context of this application, 'Internet' should be interpreted broadly to cover any large-area networks using Internet Protocols (IP). Especially it is the applicant's intention to include future developments, such as Internet 2 or NGI ('Next generation Internet'), and corporate networks, commonly referred to as intranets or ex-

tranets.

10 A person designing an Internet access mechanism faces several issues, such as interoperability, security, billing, economic use of IP addresses, and how to make the best use of installed equipment, etc.

From references [1, Kwok et al.] and [2, Nilsson et al.] are known Internet access mechanisms for connecting each of several customer premises equipment (abbreviated "CPE") via an ATM network to one of several service providers (SP). The concept of service provider comprises Internet service providers (ISP), content providers (CP, for video-on-demand, etc.), and corporate network servers (CNS, for telecommuting, etc.)

Referring to Fig. 1, CPEs are connected to the ATM network at network termination points (NT). A typical NT, such as NT1 in Fig. 1, is a network gateway having a network interface for the customer's local area network, LAN, and another interface towards the ATM network. Alternatively, a personal computer PC or a workstation WS can be connected directly (without a LAN) to the ATM network by means of an ATM/ADSL adapter card (shown as NT2), which in this case is the NT. In both cases, there is a well-defined NT for each CPE (although one NT may serve several CPEs). According to both cited references, the network comprises an access server function, or ASF, having a connection to each NT and each SP such that each NT has a permanent connection or a permanent virtual connection to the ASF. The wording 'access server function' implies that the ASF can be a dedicated network element or it can be integrated into or co-located with another network element, such as an ATM switch. In the cited references, the ASF has been referred to as an 'access node'/'DSLAM' (digital subscriber line access multiplexer) or an 'edge router'. It should be noted that the difference between 'permanent connection' and 'permanent virtual connection' has become rather blurred and later in this application, only 'permanent virtual connection' (PVC) will be used.

A problem of the known Internet access mechanisms is that they do not give a satisfactory answer to following problem: How can a specific end-user be connected to the desired service provider with a minimal number of permanent virtual circuits (PVCs) with a possibility of end-user authentication taking place only at the ends of the PVCs (not necessarily at the ASF)?

Disclosure of the invention

An object of the invention is to solve or at least minimise the problem associated with the prior art access mechanisms. The object is achieved with a method and equipment which are characterized by what is disclosed in the attached independent claims. Preferred embodiments of the invention are disclosed in the attached dependent claims.

The invention is based on establishing a tunnelling protocol on the permanent virtual connection between each CPE or NT and the ASF, wherein the tunnelling protocol is able to support an integrated signalling protocol. Selecting an appropriate SP is based on the integrated signalling protocol. Routing to the selected SP is performed by the ASF. Finally, the ASF connects the CPE or NT to the selected SP using the integrated signalling protocol.

Within the context of this application, 'tunnelling protocol' refers to a protocol which allows creating and maintaining virtual private sessions via various network media such as IP, ATM, Frame Relay, etc. Correspondingly, 'integrated signalling protocol' (i.e. a signalling protocol integrated into the tunnelling protocol) refers to a control protocol which is used for creating, maintaining and releasing these sessions.

Implementation of the invention, however, raises two new issues: the ATM network must provide non-ATM functions in the ASF, and, unless properly dimensioned, the ASF can be a performance bottleneck. Such non-ATM functions performed by the ASF include functions above the ATM layer for the user connections, namely SAR/AAL5, the entire tunnelling protocol and selecting the SP by L2 signalling. These functions require appropriate administration. After a careful study of the pros and cons of the invention, it will be observed that there are situations where the advantages of the invention justify the added complexity of the ASF.

According to a preferred embodiment of the invention, one permanent virtual connection PVC is provided from the ASF to each SP. Alternatively, there is provided a pool of permanent virtual connections from the ASF to each SP. One PVC is allocated to each CPE from this pool. As a further op-

tion, it is possible to establish one switched virtual connection (SVC) from the ASF to each SP, on the basis of signalling which the ASF receives from the CPE via the tunnelling protocol.

- 5 The tunnelling protocol can be established only in response to detecting appropriate user activity in a CPE. Alternatively, the tunnelling protocol can be permanent and the integrated signalling is initiated and the user is authenticated only in response to detecting appropriate user activity in the CPE. According to a further preferred embodiment, the user is authenticated twice, first by the ASF using the tunnelling protocol, and then by the SP.

10 **Brief description of the drawings**

The invention will be described in more detail by means of preferred embodiments with reference to the appended drawing in which:

Fig. 1 is a block diagram illustrating the Internet/intranet access mechanism according to the invention.

15 **Detailed description of the invention**

- Fig. 1 a is block diagram comprising several customer premises equipment CPE, connected via network termination points NT to an access server function ASF according to the invention. The ASF can be a dedicated network element, or it can be integrated into or co-located with another network element, such as an ATM switch (which is known to a skilled person and not shown separately).

- 20 The ASF provides access from each CPE to several service providers SP, such as Internet service providers ISP, content providers CP and corporate networks CN. The invention requires no changes to the construction or operation of the SP equipment. Instead, the invention can be implemented in the ASF and the NT. There is preferably one permanent virtual connection (PVC) between each NT and the ASF.

- 30 In the embodiment shown in Fig. 1, there is one PVC from NT2 (in the workstation WS) to the ASF. Also, assuming that at least one of the personal computers PC is active, there is also a PVC from NT1 to the ASF. All the personal computers PC connected to the LAN share the PVC between NT1 and the ASF. According to a preferred embodiment of the invention, there is a tunnelling protocol, such as L2TP (Layer 2 Tunnelling Protocol), on the PVC from each active PC to the NT. The tunnelling protocol combines the sessions and signalling from all active PCs into a single tunnel from the NT to the ASF.
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The tunnelling protocol must be able to support an integrated signalling protocol. The end user (i.e. the person using the CPE or a software agent being executed in the CPE) selects an appropriate SP by using the integrated signalling protocol. Routing to the selected SP is performed by the ASF. Finally,
5 the ASF connects the CPE or NT to the selected SP using the integrated signalling protocol.

Reference 11 points to a preferred protocol stack at the NT and reference 12 points to a preferred protocol stack at the ASF. (The workstation WS connected to NT2 without a LAN needs a simpler protocol stack, consisting only of the right half of the protocol stack 11, i.e. PPP, L2TP, AAL5, ATM,
10 and PHY.) Having point-to-point connectivity PPP over L2TP provides end-to-end security. In other words, it is not necessary for the ASF to authenticate the user, although the ATM operator may still choose to do so, in order to charge the subscriber for the duration of the session. However, even in this case, the
15 end-user's choice of SP is not known to the ATM operator, which is a clear benefit to the owners of the SPs.

The preferred embodiment saves a considerable amount of PVCs over the prior art access mechanisms. Let us calculate an example case of 10 000 customers and 8 SPs and 20 ASFs (one ASF per 500 CPE). If all customers need access to all SPs, the prior art access mechanisms require a
20 separate PVC for each customer/SP combination, i.e. in this example $8 * 10\,000 = 80\,000$ PVCs. In comparison, the mechanism according to the invention requires a PVC only for each customer and each ASF/SP combination, i.e. $10\,000 + 8 * 20 = 10\,160$ PVCs. (This number is not perfectly accurate since
25 some ASF/SP connections can be switched virtual connections, SVC.)

According to an alternative embodiment of the invention, there is a separate PVC from each active PC between the NT and the ASF. In this case, implementation of the NT is easier because the tunnels from the PCs do not have to be combined (instead, all tunnels pass from the PCs, over the LAN,
30 through the NT to the ASF).

The ATM operator's billing can be based on the time there is a PVC between the customer and the ASF. The invention simplifies this kind of billing because there is only one PVC from each customer. Also, when the customer changes the SP, a new PVC configuration is not needed.

35 Configuring and managing the NT device according to the invention, like the device itself, is rather simple. Only its LAN interface and its ATM

interface require configuration: an IP address, a subnet mask and an ATM PVC. The latter can be received automatically, using a technique known as ILMI (Interim Local Management Interface) as defined by ATM Forum UNI (User to Network Interface) 3.1. ILMI supports bidirectional exchange of management information between UNI management entities related to the ATM layer and physical layer parameters. Correspondingly, the LAN interface can be configured automatically by a process known as DHCP (Dynamic Host Configuration Protocol), as defined by the Internet Software Consortium.

The description only illustrates preferred embodiments of the invention. The invention is not, however, limited to these examples, but it may vary within the scope of the appended claims.

References:

1. Kwok, Timothy et al: *An Interoperable End-to-End Broadband Service Architecture over ASDL Systems*, version 1.0, 3 June, 1997, available at address <http://www.3com.com/xdsl/microwt.html> at the priority date of this application.

2. Nilsson, Patrik et al: *Anx -- High-speed Internet Access*, available at address http://www.ericsson.com/Review/er1b_98/art4/art4.html at the priority date of this application. The www address implies that reference 2 was printed in Ericsson Review magazine.

Both cited references are incorporated herein by reference.

Claims

1. A method for connecting one of several customer premises equipment, or CPE, via an ATM network to one of several service providers, or SPs, said method comprising:
 - 5 connecting each CPE to the ATM network via a corresponding network termination point, or NT; and
 - forming an access server function, or ASF, having a permanent virtual connection to each NT and a connection to each SP;
 - characterized in that
 - 10 a tunnelling protocol is established on said permanent virtual connection between each NT and said ASF, said tunnelling protocol being able to support an integrated signalling protocol;
 - the CPE or its user selects an appropriate SP by using said integrated signalling protocol;
 - 15 routing from said CPE to said selected SP is performed by said ASF; and
 - said ASF connects the CPE to the selected SP using said integrated signalling protocol.
2. A method according to claim 1, characterized by providing
20 one permanent virtual connection from the ASF to each SP.
3. A method according to claim 1, characterized by providing a pool of permanent virtual connections from the ASF to each SP; and allocating one connection to each NT from said pool.
4. A method according to claim 1, characterized by establishing
25 lishing one switched virtual connection (SVC) from the ASF to each SP, on the basis of signalling which the ASF receives from said CPE via said tunnelling protocol.
5. A method according to claim 1, characterized by establishing said tunnelling protocol only in response to detecting appropriate activity
30 in said CPE.
6. A method according to claim 1, characterized by establishing said tunnelling protocol permanently and initiating said integrated sig-

nalling and authenticating the user of said CPE only in response to detecting appropriate activity in said CPE.

7. A method according to claim 1, characterized by authenticating the user of said CPE both by said ASF and by the selected SP.

5 8. A network element (ASF) providing an access server function for connecting each of several customer premises equipment, or CPE, via an ATM network to one of several service providers, or SPs, said network element comprising:

 interface means to several network termination points, or NTs for
10 connecting each CPE to the ATM network via a corresponding NT; and
 interface means to each SP for providing a permanent virtual connection or a switched virtual connection thereto;

 characterized in that the network element is arranged to:
 use a tunnelling protocol on said permanent virtual connection between
15 itself and each NT, said tunnelling protocol being able to support an integrated signalling protocol;

 select an appropriate SP in response to signalling from each CPE or its user, said selecting being carried out using said integrated signalling protocol;

20 support routing from each CPE to said selected SP; and
 connect each CPE to the selected SP using said integrated signalling protocol.

 9. A network element (ASF) according to claim 8, characterized in that it is arranged to provide one permanent virtual connection from
25 itself to substantially each SP.

 10. A network element (ASF) according to claim 8, characterized in that it is arranged to provide a pool of permanent virtual connections from itself to each SP and to allocate one connection to each active NT from said pool.

30 11. A network element (ASF) according to claim 8, characterized in that it is arranged to provide a switched virtual connection from itself to at least one SP.

12. A network element (ASF) according to claim 8, characterized in that it is arranged to provide a separate tunnel from itself to substantially each CPE.

13. A network element (ASF) according to claim 8, characterized in that it is arranged to cooperate with an NT between itself and each CPE,

said NT being arranged to provide a separate tunnel from itself to substantially each CPE and to combine the separate tunnel into fewer tunnels, preferably a single tunnel, from itself to the ASF.

Fig. 1

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